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# Development and Evaluation of a High School Rating Conversion Table for NROTC Applicants

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Regina L. Burch  
Norman M. Abrahams  
Jack E. Edwards

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Table for NROTC Applicants**

Regina L. Burch  
Navy Personnel Research and Development Center  
San Diego, CA 92152-6800

Norman M. Abrahams  
Personnel Decisions Research Institute  
Minneapolis, MN 55414

Jack E. Edwards  
Navy Personnel Research and Development Center  
San Diego, CA 92152-6800

Reviewed by  
Idell Neumann

Approved by  
Patricia J. Thomas

Released by  
Jules I. Borack  
Director, Personnel Systems Department

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13. ABSTRACT (Maximum 200 words) † Naval Reserve Office Training Corps (NROTC) scholarship applicants are evaluated, in part, on their high school rating (HSR). HSR is a selection variable that reflects individuals' percentile rank in their high school class. For those applicants who are missing a percentile rank, their HSR must be estimated using their high school grade point average (HSGPA). The current HSGPA-to-HSR conversion table has been used to estimate individuals' HSR for several years. Recently, Chief of Naval Education and Training (CNET) officials have questioned whether the conversion table overestimates HSR when a student's high school rank is unknown. The purpose of the present study was to evaluate the accuracy of the current HSGPA-to-HSR conversion table and to develop a revised HSGPA-to-HSR conversion table. An equipercentile method of equating was used to develop the revised HSGPA-to-HSR conversion table. Cross-validation of this table was conducted on a holdout sample, and comparisons between the table currently in use and the revised table were performed. The results showed that the current HSGPA-to-HSR conversion table does overestimate HSR. A revised HSGPA-to-HSR conversion table was substantially more accurate than the current conversion table for estimating individuals' HSR. This finding is important due to the large weight assigned to HSR in the current NROTC selection composite. It is recommended that the revised HSGPA-to-HSR conversion table should replace the table currently in use. When sufficient criterion data become available, the predictive validity of the revised HSR table should be evaluated.				
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## FOREWORD

This effort was conducted under the sponsorship of the Office of Naval Technology, within program element 0602233N, project task RM33M20.05 Integrating Officer Selection Systems (IOSS). Prior publications completed within this program element and work unit number are listed below.

The present report describes the development of an improved high school rating conversion table for use with Naval Reserve Officer Training Corps (NROTC) applicants. The use of this table is expected to result in a more accurate evaluation of applicants' high school performance.

The authors would like to express their appreciation to CDR Bob Hawkins and LT Joanne Reese for their help in completing this project.

JULES I. BORACK  
Director, Personnel Systems Department

### Prior Publications:

- Alf, E. F., Neumann, I., & Mattson, J. D. (1988). *Revision of the United States Naval Academy selection composite* (NPRDC-TN-88-61). San Diego: Navy Personnel Research and Development Center.
- Borman, W. C., Owens-Kurtz, C. K., Peterson, V. A., & Mattson, J. D. (1989). *Attrition from NROTC: A review and critical analysis of the issues* (NPRDC-TN-89-15). San Diego: Navy Personnel Research and Development Center.
- Kantor, J. (1989). *The utilization of biographical information for the reduction of motivational attrition in the NROTC scholarship program* (NPRDC-TN-89-21). San Diego: Navy Personnel Research and Development Center.
- Mattson, J. D., Neumann, I., & Abrahams, N. M. (1986). *Development of a revised composite for NROTC selection* (NPRDC-TN-87-7). San Diego: Navy Personnel Research and Development Center.
- Neumann, I., Mattson, J. D., & Abrahams, N. M. (1989). *Development and evaluation of an officer potential composite* (NPRDC-TR-89-18). San Diego: Navy Personnel Research and Development Center.
- Owens-Kurtz, C. K., Borman, W. C., Gialluca, K. A., Abrahams, N. M., & Mattson, J. D. (1989). *Refinement of the Naval Reserve Officer Training Corps (NROTC) scholarship selection composite* (NPRDC-TN-90-1). San Diego: Navy Personnel Research and Development Center.

## **SUMMARY**

### **Problem**

Naval Reserve Officer Training Corps (NROTC) scholarship applicants are evaluated, in part, on their high school rating (HSR). HSR reflects an individual's percentile rank in his/her high school class while taking into account the percentile ranks of the other students who have applied for NROTC scholarships. For an applicant who is missing a percentile rank in high school, HSR must be estimated using the applicant's high school grade point average (HSGPA). The current HSGPA-to-HSR conversion table has been used to estimate HSR for several years. Recently, Chief of Naval Education and Training (CNET) officials have questioned whether the conversion table overestimates HSR when a student's high school rank is unknown.

### **Objective**

The purpose of the present study is to evaluate the accuracy of the current HSGPA-to-HSR conversion table and, if indicated, to develop a revised HSGPA-to-HSR conversion table.

### **Approach**

An equipercentile method of equating was used to develop a revised HSGPA-to-HSR conversion table on a representative sample of applicants who had both HSGPA and HSR. Cross-validation of this table was conducted on a hold-out sample, and comparisons between the table currently in use and the revised table were performed.

### **Results and Conclusions**

1. As indicated by CNET officials, the current HSGPA-to-HSR conversion table does overestimate HSR.
2. The revised HSGPA-to-HSR conversion table is substantially more accurate than the current conversion table for estimating HSR. In fact, the number of perfect estimates increased by over 70 percent. The improvement in the estimation of HSRs using this revised table is important due to the large weight assigned to HSR in the current NROTC selection composite.

### **Recommendations**

It is recommended that CNET replace the current HSGPA-to-HSR conversion table with the revised conversion table. Additionally, when sufficient criterion data become available, the Navy Personnel Research and Development Center should evaluate the validity of the revised HSR conversion table in predicting grade point average in college, naval science grades, and later performance in the Navy.

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## INTRODUCTION

### Problem and Background

Approximately 12,000 individuals apply and become finalists for Naval Reserve Officer Training Corps (NROTC) scholarships each year. Four-year scholarships are awarded to approximately 1,500 of these applicants. The scholarship pays for tuition, textbooks, instructional fees, and summer training periods, as well as provides the selectee with \$100 per month (for a maximum of 40 months). Selectees may become a member of any of the 67 NROTC units that service 192 colleges and universities located nationwide.

Applicants are evaluated for an NROTC scholarship based on their scores on the Quality Index (QI), a predictor composite that includes six academic and personal factors: Scholastic Aptitude Test-Verbal (SATV), Scholastic Aptitude Test-Math (SATM),<sup>1</sup> high school class rating (HSR), an interviewer's rating (INTER), a scale developed from the Strong Campbell Interest Inventory (SCII) to predict officer retention for at least 1 year beyond an individual's minimum obligated service, and a scale from the background questionnaire (BQ) that predicts completion of the NROTC program. Recently, researchers (Burch & Abrahams, in press; Mattson, Neumann, & Abrahams, 1986; Owens-Kurtz, Borman, Gialluca, Abrahams, & Mattson 1989) have combined these factors to optimally predict college grade-point average, naval aptitude grades, naval science grades, and choice of final major.

Burch and Abrahams (in press), Mattson et al. (1986), and Owens-Kurtz et al. (1989) have shown HSR to be the most important factor in the selection composite. HSR is a score derived from an applicant's percentile rank in high school. Approximately 6 percent of the NROTC-scholarship applicants are missing rank in class (RIC), class size (CLASIZE), or both of these components, making it impossible to compute a percentile rank. For these applicants, a conversion table (Navy Recruiting Command, 11-31.2, 1988) is employed to estimate HSR using the individual's high school grade point average (HSGPA). This conversion table is reproduced as Table 1. To use the table, an applicant's HSR is estimated by identifying the appropriate HSGPA in the center column and then finding the corresponding HSR in the left-hand column. Although this table has been used for several years, Chief of Naval Education and Training (CNET) officials have indicated that it appears to overestimate an individual's HSR in recent applications.

### Objective

The objectives of the present study were to: (1) evaluate the accuracy of the current HSGPA-to-HSR conversion table and, if indicated, (2) develop a revised HSGPA-to-HSR conversion table that can be used to estimate HSR values when only HSGPA is available.

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<sup>1</sup>ACT scores were translated to equivalent SAT scores using a recently developed conversion table (Owens-Kurtz, Borman, Gialluca, Abrahams, & Mattson, 1989).



**Table 1**

**High School Record Rating and Grade Point Averages for Various  
Percentile Ranks Using Current Conversion Table**

<b>HSR</b>	<b>HSGPA</b>	<b>Equivalent Percentile Rank</b>
100	4.00	99 and up
90	3.70 thru 3.99	97-98
80	3.40 thru 3.69	95-96
70	3.20 thru 3.39	89-94
60	2.90 thru 3.19	81-88
50	2.60 thru 2.89	70-80
40	2.20 thru 2.59	56-69
30	1.90 thru 2.19	42-55
20	1.60 thru 1.89	26-41
10	1.20 thru 1.59	10-25
0	0 thru 1.19	9 and below

**APPROACH**

**Sample**

The initial sample consisted of 10,785 finalists who had applied for NROTC scholarships in 1989. To be a finalist, an applicant is required to have minimum SATV and SATM scores of 450 and 500, respectively. Males comprised 91.3 percent of the sample; nonminorities comprised 88.4 percent of the sample.

**Measures**

**High School Rating (HSR)**

An individual's RIC and CLASIZE are provided by a high school official. These numerical values are used to compute an individual's actual percentile rank in his/her high school class.

$$\text{Percentile Rank} = \frac{(\text{RIC} \times 2) - 1}{\text{CLASIZE} \times 2}$$

Next, the obtained percentile rank is converted to an equivalent HSR using Table 1. If, for example, an individual's high school percentile rank were 95, the person performing the conversion would locate 95 in the right-hand column and find that it corresponds to an 80 in the HSR column.

Although HSR varies from 0 to 100 in increments of 10, the reader is cautioned to avoid assuming that HSR is decile-based. HSR uses an 11-point scale and provides maximum differentiation among the most qualified candidates. As can be seen in Table 1, each of the higher HSR values covers only a few percentile ranks; whereas, lower HSR values encompass a relatively larger number of percentile ranks. For example, HSRs of 70 and above include 6 or fewer percentile ranks. In contrast, the lower HSR values each cover 10 to 15 percentile ranks. The specific percentile ranks and associated HSR values must remain the same to ensure longitudinal comparability.

### Grade Point Averages

Two measures of high school grade-point average were used in the present study. One measure (HSGPA) is an applicant's cumulative grade-point average earned in all high school classes and is supplied by a high school official. Although HSGPA is reported on a variety of numerical scales (e.g., 0 to 100.00, 0 to 6.00, and 0 to 5.00), most high schools use a 0-to-4.00 scale, with an "A" equal to 4.00. The applicant's HSGPA is reported on the Request for Secondary School Transcript (i.e., part of the NROTC application package).

The other measure is an applicant's self-reported cumulative grade-point average (SRGPA) based on grades earned from all high school classes. It is obtained from the background information that is gathered during the administration of the Scholastic Aptitude Test (SAT) or the American College Test (ACT). The SAT-obtained SRGPAs were converted from letter grades to numerical grades using Table 2; ACT-obtained SRGPAs were already in the numerical format.

Table 2

### Letter Grades and Corresponding Grade Point Averages

Letter Grade	Grade Point Average	Grade Letter Grade	Point Average
A+, A	4.00	C	2.00
A-3	.70	C-	1.70
B+	3.30	D+	1.30
B	3.00	D	1.00
B-	2.70	D-	0.70
C+	2.30	F	0.00

## **Procedure**

### **Sample Development**

Only 9,955 of the 10,785 finalists had complete HSR, RIC, CLASIZE, HSGPA, and SRGPA information. As a result, data from 830 individuals were eliminated from further analyses because their HSRs were previously estimated from HSGPAs (rather than obtained directly from RIC and CLASIZE).

### **Determining the Scale for HSGPA**

Only the data from individuals who had an HSGPA that was based on a 4.00 scale could be used in developing the conversion table. The 0-to-4.00 grading scale, shown in Table 2, was chosen because of its prevalence and the uniform assignment of numerical values to given letter grades. For example, an HSGPA of 3.00 corresponded to a "B" letter grade at most schools. This situation was not the case for all grade-point-average scales (e.g., 5.00 or 6.00 scales).

To identify an applicant whose HSGPA grade was based on a 4.00 scale, we initially examined the school official's report of the grading scale used. On the same data sheet that contains an applicant's HSGPA, the school official was asked whether the HSGPA was based on a 4.00 scale. This question required a simple response of "yes" or "no" rather than an indication of which scale is actually used. Unfortunately, the school officials' responses to this question were frequently missing or inconsistent (e.g., an individual had an HSGPA of 6.00 while the school official indicated that a 4.00 scale was used).

These deficiencies made it necessary to use an alternate procedure for identifying students who were graded with a 4.00 scale. A computer program (Devlin, 1989) that was developed for use with the United States Naval Academy admissions data was adopted for this purpose. This program compares an applicant's HSGPA and SRGPA. Because an SRGPA is known to be computed using a 4.00 scale, little difference should exist between an HSGPA that is actually on a 4.00 scale and an applicant's SRGPA.

To determine whether an HSGPA was on a 4.00 scale, each SRGPA was compared to its corresponding HSGPA. Using various levels of deviations between self- and school-reported grades, three groups were created. If the difference between self- and school-reported grades did not exceed .30 (either plus or minus), the applicant was included in Group 1. This procedure identified 5,183 applicants who could be assumed, with some confidence, to have HSGPAs based on a 4.00 scale. In a similar way, two additional groups were identified. Group 2 ( $N = 4,048$ ) consisted of those finalists whose self- and school-reported grade-point averages differed by no more than .20; whereas, Group 3 ( $N = 2,414$ ) consisted of individuals whose two grade-point averages differed by no more than .10. Because the differences found in Groups 2 and 3 were smaller than the difference of .30 found in Group 1, HSGPAs for the former groups could be assumed with greater confidence to have been based on a 4.00 scale. Information on the 4,772 individuals who had difference scores larger than plus or minus .30 was not used in subsequent steps; the scale for their grade-point averages could not be determined with confidence.

### **Accuracy of Current Conversion Table**

The accuracy of the current conversion table was assessed by computing difference scores between individuals' actual and estimated HSRs. An examination of the difference-score distribution indicated whether the current table accurately estimated HSR values.

### **Conversion Table Development**

Conversion tables were developed for Groups 1 and 3 using standard equipercentile methods for equating (Petersen, Kolen, & Hoover, 1989). If the two sets of HSR estimates were similar, then a conversion table for Group 2 would not be necessary. The following steps were used to create each table. First, separate cumulative percentage distributions were constructed for HSR and HSGPA. Second, the percentile rank was determined for each HSR, and the HSGPA at the same rank was identified. This process continued until each of the 10 HSR values had corresponding (i.e., at the same percentiles) upper and lower limits for HSGPA.

For example, if 8 percent received an HSR of 100 and 15 percent received an HSR of 90, the HSGPAs corresponding to these values could be determined. Since 4.00 is the maximum HSGPA, the HSGPA upper limit for an HSR of 100 would be 4.00. The lower limit for an HSR of 100 would be the HSGPA value that results in 8 percent of the individuals within the HSGPA range (e.g., 3.97). The HSGPA upper limit for an HSR of 90 would then be 3.96, and the lower limit would be the HSGPA value that results in 15 percent of the individuals within the HSGPA range (e.g., 3.91). Therefore, individuals with an HSGPA between 3.91 and 3.96 would be given an estimated HSR of 90, and individuals with an HSGPA between 3.97 and 4.00 would be given an estimated HSR of 100.

When the exact percentile rank for a given HSR could not be matched to the percentile for HSGPA, the HSGPA value with the percentile closest to the HSR percentile was used. In most cases, the difference in percentiles for an HSR-HSGPA pair was less than 1 percentile point. The percentile difference was considerably larger only once--for the HSR of 100. For both Group 1 and Group 3, the percentage of individuals receiving an HSR of 100 was less than the percentage of individuals receiving an HSGPA of 4.00. In essence, it was not possible to match the HSGPA percentage to the HSR percentage. In this case, all 4.00 individuals were given an estimated HSR of 100, and the percentile difference was taken off the following HSR value (i.e., the 90 category).

Upon completion of the conversion tables, comparisons were made of the HSR estimates derived for Groups 1 and 3. As previously stated, if the two sets of HSR estimates were similar, then a conversion table for Group 2 would not be necessary. If, on the other hand, large differences occurred, further investigation (e.g., development of a conversion table for Group 2) would be necessary.

Once a Group was selected, it was split into two subsamples of approximately equal size to determine whether a table developed on one subsample would produce similar results when applied to another independent subsample. Accordingly, a conversion table was developed for one subsample and then cross-validated using the other subsample.

## RESULTS AND DISCUSSION

Figure 1 provides the difference-score distribution obtained using the current conversion table. The modal difference score between actual and estimated HSRs was 10. This finding indicated that the current table overestimates an individual's HSR and that development of a revised table was necessary.

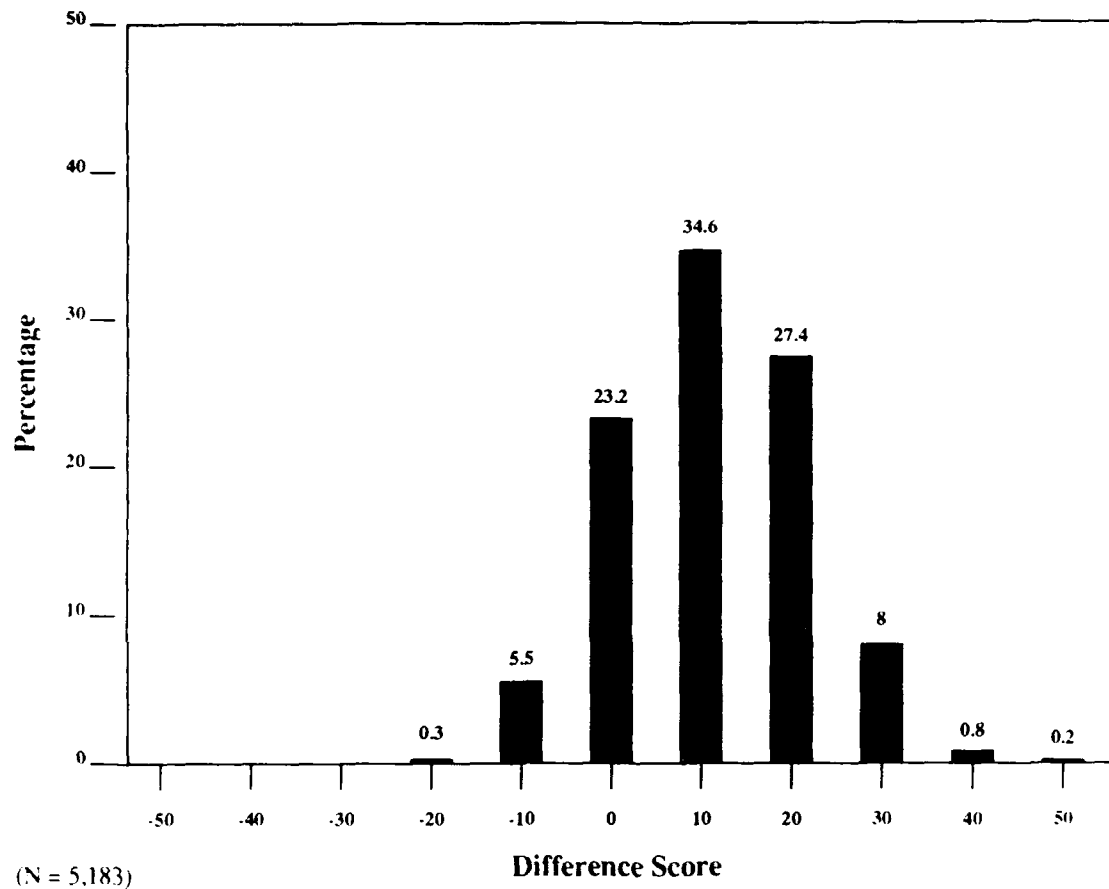


Figure 1. Difference scores using current table.

Table 3 contains the means for the QI (i.e., the current selection composite) and the variables that are used to derive it. Mean comparisons were made to determine the degree of similarity between the three groups. The differences between the largest and smallest means for SCII, BQ, SATV, and SATM were each .10 or less of the corresponding Group 1 standard deviation. The differences for QI and HSR were .19 of one standard deviation.

Table 3

## Means and Standard Deviations on QI and its Components

Variable	Group					
	1		2		3	
	(N = 5,183)		(N = 4,048)		(N = 2,414)	
	Mean	SD	Mean	SD	Mean	SD
QI	251.79	20.17	252.98	20.45	255.57	21.20
SCII	103.58	6.35	103.47	6.39	103.39	6.44
BQ	100.94	2.31	100.94	2.31	100.93	2.29
SATV	558.85	68.23	560.79	68.47	562.61	68.71
SATM	629.24	67.72	631.39	67.97	635.90	68.65
HSR	70.52	17.68	71.58	17.98	73.86	18.78
INTER	1.25	.63	1.25	.63	1.24	.61

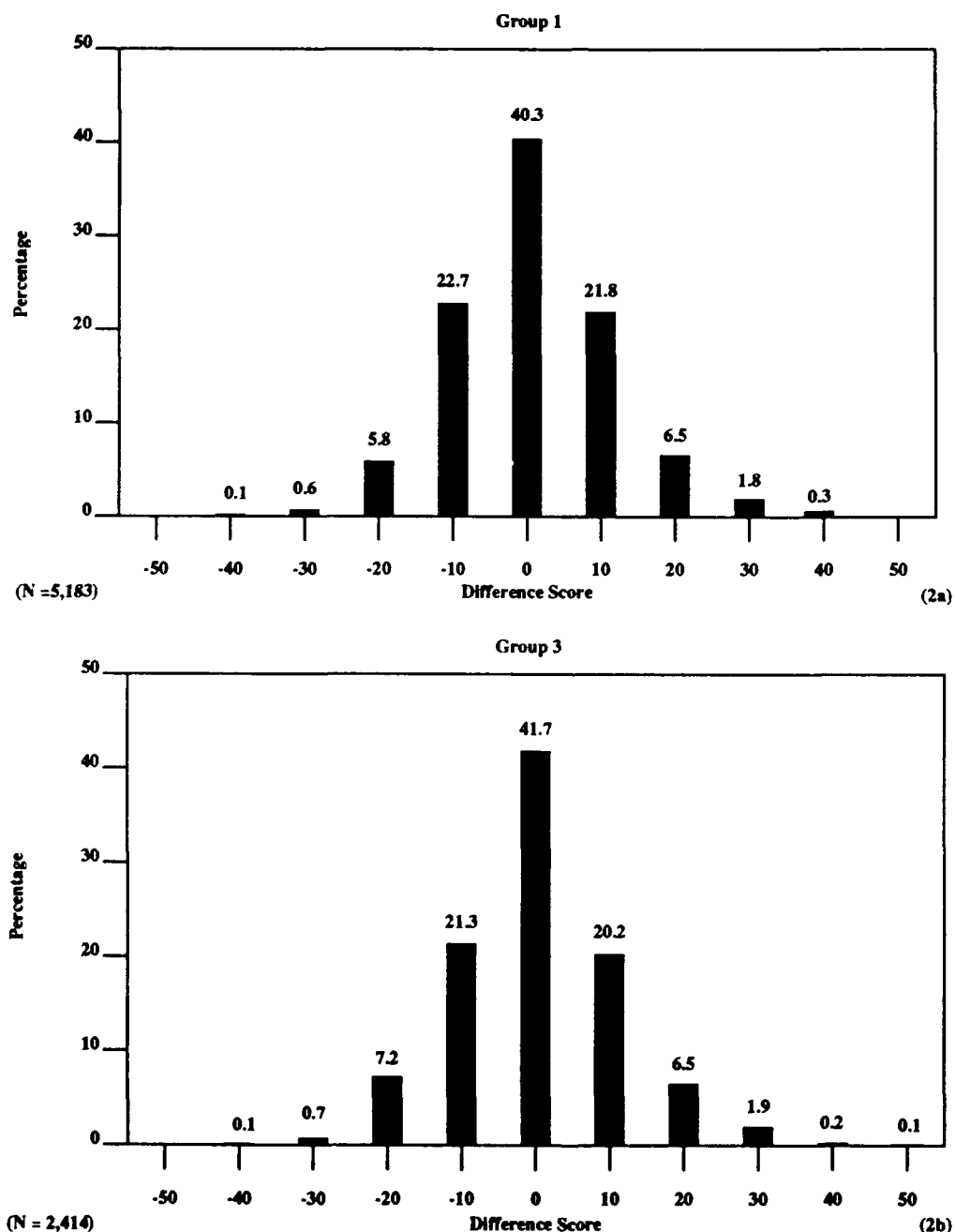
To investigate other possible differences in the outcomes for Groups 1 and 3, a difference score between each individual's actual and estimated HSR was computed. Figure 2 shows that the difference-score distributions for the two groups were very similar. The percentage of individuals for whom correct estimates were made was virtually the same for the two groups. Similarly, the patterns of the deviations from correct estimates were nearly identical. Taken together, these findings suggested that the two tables are essentially equivalent with regard to the accuracy of HSR estimates. The desire to develop a table on a larger, more representative sample resulted in the decision to use the conversion table developed on Group 1 in the remaining analyses.<sup>2</sup>

The conversion table developed on one subsample of Group 1 was cross-validated by computing differences between actual and estimated HSRs on the other Group 1 subsample. Figure 3 shows these difference scores. The distribution of errors for the full Group 1 sample (see Figure 2a) and the Group 1 cross-validation subsample were very similar.

Applying the three conversion tables, the current, the full-sample (i.e., Group 1), and the half-sample (i.e., cross-validation subsample of Group 1), HSGPAs were used to estimate HSRs for all individuals in the full Group 1 and just for those individuals who were in the Group 1 cross-validation subsample. Table 4 contains the difference-score distributions. The distributions for the full- and half-sample tables were very similar, and both distributions showed that the full- and half-sample conversion tables provided more accurate HSR estimates than did the current conversion table. For the current table, correct estimates were made approximately 23 percent of the time for both Group 1 and its subsample. In contrast, correct estimates were made for approximately 40 percent

<sup>2</sup>The use of Group 1, with its plus or minus .30 boundaries, had the added advantage of including individuals whose grades in honors courses resulted in overall grade-point averages between 4.00 and 4.30.

of the individuals in Group 1 or its subsample when either of the revised conversion tables was employed. Consistent with Figure 1, Table 4 shows that the CNET representatives were correct when they suggested that the current table overestimates HSR.



Note. Due to rounding error, the percentages do not add up to exactly 100.

Figure 2. Differences scores for group 1 and group 3.

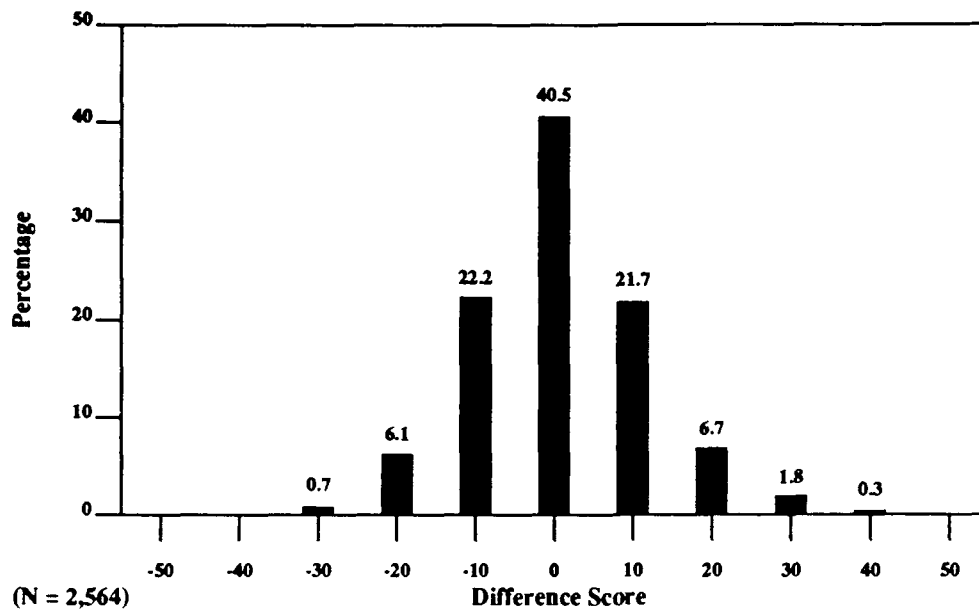


Figure 3. Difference scores for cross-validation sample.

Table 4

**Difference Score Distributions for Estimated HSR and Actual HSR Using  
Current Table and Two Revised Tables**

Difference Score	Percentage for Full Sample (N = 5,183)			Percentage for Half Sample (N = 2,564)		
	Current Table	Revised Full-sample Table	Revised Half-sample Table	Current Table	Revised Full-sample Table	Revised Half-sample Table
-50	0.0	0.0	0.0	0.0	0.0	0.0
-40	0.0	.1	.1	0.0	0.0	0.0
-30	0.0	.6	.6	0.0	.7	.7
-20	.3	5.8	5.7	.2	6.1	6.1
-10	5.5	22.7	22.8	5.5	22.0	22.2
0	23.2	40.3	40.2	23.3	40.7	40.5
10	34.6	21.8	21.8	35.4	21.5	21.7
20	27.4	6.5	6.5	26.5	6.7	6.7
30	8.0	1.8	1.8	8.1	1.8	1.8
40	.8	.3	.3	.8	.3	.3
50	.2	0.0	0.0	.2	0.0	0.0

Note. Due to rounding error, the percentages do not add up to exactly 100.



Based on the similarities between the full- and half-sample tables, the conversion table developed on the full-sample was chosen to replace the current HSGPA-to-HSR conversion table. This revised table is shown in Table 5. A comparison of the values in the revised table with those in the current table (see Table 1) illustrates again the tendency of the current table to overestimate HSR. For example, an applicant with an HSGPA between 3.70 and 3.99 would be assigned an HSR of 90 if the current table were used. On the other hand, the same individual would have needed an HSGPA between 3.94 and 3.99 to be assigned an HSR of 90 using the revised table.

**Table 5**

**High School Rating and Grade Point Averages for Various  
Percentile Ranks Using Revised Conversion Table**

HSR	HSGPA	Equivalent Percentile Rank
100	4.00	99 and up
90	3.94 thru 3.99	97-98
80	3.79 thru 3.93	95-96
70	3.54 thru 3.78	89-94
60	3.25 thru 3.53	81-88
50	3.00 thru 3.24	70-80
40	2.73 thru 2.99	56-69
30	2.48 thru 2.72	42-55
20	2.00 thru 2.47	26-41
10	1.62 thru 1.99	10-25
0	0 thru 1.61	9 and below

Although there are still errors in estimation using the revised table, these errors are not systematic in that the revised table does not consistently underestimate or overestimate an individual's HSR. The large weight assigned to HSR in the selection system makes the implementation of a more accurate conversion table of great importance. This improvement in estimating HSR, the most important variable in the selection composite, should increase overall validity.

**SUMMARY AND CONCLUSIONS**

1. As indicated by CNET officials, the current HSGPA-to-HSR conversion table overestimates an individual's HSR.

2. The revised HSGPA-to-HSR conversion table is substantially more accurate than the current conversion table for estimating an individual's HSR. For example, the number of perfect estimates increased by over 70 percent when the new table was used in place of the old table. Similarly, 84.4 percent of the conversions are with  $\pm 1$  unit of a perfect prediction for the new table whereas only 63.3 percent are at a similar level of accuracy when the old table is used. The improvement in the estimation of HSRs using the revised table is particularly significant due to the large weight assigned to HSR in the current NROTC scholarship selection system.

### **RECOMMENDATIONS**

It is recommended that CNET replace the current HSGPA-to-HSR conversion table with the revised conversion table. Additionally, when sufficient criterion data become available, the Navy Personnel Research and Development Center should evaluate the validity of the revised HSR conversion table in predicting grade point average in college, naval science grades, and later performance in the Navy.

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